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LEAF BLIGHT OF THE TOMATO[1]

This is the most important fungous disease *(Septoria lycopersici)* of the tomato in New Jersey. It starts in the extreme southern part of the state about July first and gradually moves northward and, therefore, is much more destructive on the late mar-

First Stage of Leaf Blight
(Note the lower leaves)

ket and can-house crops than on the early tomatoes. It is most destructive in those localities in which tomatoes are grown extensively, especially for the canneries. The average loss has been estimated by the United States Department of Agriculture at $25 per acre and the total loss for the United States at approximately $5,000,000 per year.

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[1]Prepared by Mel. T. Cook, Ph. D., Plant Pathologist and W. H. Martin, M. Sc., Assistant Plant Pathologist, of the New Jersey Agricultural Experiment Station, April 1, 1918.

Symptoms

The disease starts on the lower leaves, causing small, dark, angular or circular spots. These spots increase in size until about 1/8 inch in diameter and the centers become grayish in color. Eventually small black pimples, which are the fruiting bodies of the fungus, appear in the center of the spots. The diseased leaves turn yellow, curl and become dry and then fall. The disease gradually moves upward along the stems, slowly defoliating them. When the disease is well advanced we find very little foliage except at the tips of the stems. This disease also attacks the stems, causing irregular discolored markings.

The Spread of the Disease

The fungus is spread from plant to plant by means of its spores (fruit of the fungus) which are produced in the small, black pimple-like fruiting bodies. These spores are so very small that we cannot see them except with the compound microscope. They are produced in great numbers and ooze out of the fruiting bodies in very small sticky masses which dry but are later liberated by the dew and rain. When moistened by the rain and dew they stick to insects, the hands and clothing of the laborers and the farm machinery, and are readily carried from plant to plant. Insects feeding on these diseased plants very naturally eat a great many fungous spores, which the junior author has demonstrated will germinate very readily after having passed through the body of the insect.

They may also be scattered for short distances by the splashing of the rain-water. When these spores come in contact with the moist surface of the leaf they germinate and start new centers of infection. The disease spreads very rapidly following its appearance in a locality. The fungus is probably carried over the winter on the old tomato plants and possibly in the soil.

Control

Cultivation. (1) The burning of the old plants is sometimes recommended but many prefer to plow the plants under and get the benefit of the decaying material. (2) Deep plowing which puts this material far enough under to hasten its decay is advantageous. (3) Rotation of crops is also advantageous, especially in communities where the acreage is not so large as to make infection from neighboring fields important. (4) The disease is not so destructive early in the season as it is late in the season. It is also less destructive on vigorous than on weak plants. Therefore, it is advantageous to grow the crop on a rich soil which produces strong, vigorous plants.

Spraying. The most generally accepted method for controlling plant diseases is by spraying with fungicides. However, spraying has not been as successful with tomatoes as with many other crops. In fact, many growers have considered tomato spraying unprofitable. This is probably due in a large measure to the fact that the machinery has not been most satisfactory, that it is difficult to cover the leaves thoroughly, that the machinery injures the plants and in some cases does more harm than good, and that most growers have not used a sufficiently large amount of the spray mixture.

In our 1916 experiments at Salem our best results were with a 4-4-50 Bordeaux mixture (i. e., 4 pounds of copper sulfate, 4 pounds of lime and 50 gallons of water). There was no advantage in using the stronger mixtures. The 2-3-50 Bordeaux (2 pounds of copper sulfate, 3 pounds of lime and 50 gallons of water) gave good results. A complete report of this work has been published in the 1916 Report of the New Jersey Agricultural Experiment Station.

In our 1917 experiments at Riverton we used the following mixtures:

1. Bordeaux (4 pounds copper sulfate, 4 pounds lime, 50 gallons water).

2. Bordeaux plus resin fish-oil soap (4 pounds copper sulfate, 4 pounds lime, 3 pounds soap, 50 gallons water).

3. Bordeaux with a small amount of lime plus resin fish-oil soap (4 pounds copper sulfate, 2 pounds lime, 3 pounds soap, 50 gallons water).

The results of these treatments are as follows:

(a) The highest yield was obtained with No. 1, the standard 4-4-50 Bordeaux mixture; the second highest yield with No. 2, the 4-4-3-50 mixture.

(b) The *best control* of the fungus (not highest yield) was obtained with No. 3, the 4-2-3-50 mixture; the second best control with No. 2, the 4-4-3-50 mixture; the third best control with No. 1, the 4-4-50 (standard) Bordeaux.

(c) The advantages of using the resin flesh-oil soap were very evident. It caused the mixture to spread and stick much better than the ordinary Bordeaux. This was very evident on plants after a heavy rainfall. It has some slight fungicidal value.

(d) There was no foliage injury with No. 3, as is ordinarily the case when an excess of copper sulfate is used.

Preparation of the Mixtures[2]

Stock Solution. In extensive spraying it is desirable to make stock solutions which can be diluted and thus used very quickly as needed. They are as follows:

(a) **Copper sulfate solution.** Dissolve the copper sulfate by using as many gallons of water as there are pounds of copper sulfate. Use a wooden or glazed earthenware container. Put the water (soft water is best) in the container; put the copper sulfate in a cloth bag and suspend just beneath the surface of the water. The copper sulfate will dissolve readily. The solution should be well stirred with a wooden stick.

(b) **Milk of lime.** Use the very best grade of quick lime. Put lime in a wooden or metal container. Slake by adding small quantities of water at intervals until the lime is thoroughly crumbled. Add water to make as many gallons of milk as there were pounds of lime. Stir thoroughly both when making up to volume and each time before dipping out for use. Use quick lime if possible but if it cannot be obtained, use one and one-third times as much hydrated lime, which can be mixed immediately without slaking.

(c) **Resin fish-oil soap suspension.** Put soap in metal or wooden container. Add water slowly and stir thoroughly. Use enough water to make as many gallons of the suspension as there are pounds of the soap. Hot water is preferable to cold water.

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[2]For Standard Bordeaux mixture, see Circular 48 of the New Jersey Agricultural Experiment Station.

MIXING THE MATERIALS. Mixing can be carried on best by using a mixing platform about the height of the spray tank.

(a) For No. 1, (i. e. the 4-4-50 or Standard Bordeaux) use two barrels with spigots in the bottoms. Put 4 gallons of the copper sulfate solution in one barrel and 4 gallons of the milk of lime in the other. Add 21 gallons of water to each barrel. Open the spigots and allow the two preparations to run into a trough leading into the spray tank. The flow from the two barrels should be as nearly equal as possible. The best mixtures are made at a temperature of about 50°F.

Or, put 4 gallons of the copper sulfate solution in the spray tank, add 42 gallons of water and then add 4 gallons of milk of lime.

Or, put 4 gallons of milk of lime in the spray tank, add 42 gallons of water, and then add 4 gallons of copper sulfate solution.

Test for Standard Bordeaux Mixture. Bordeaux mixture should always be tested before using. If insufficient lime is used in the making, or if the lime is poor in quality, the copper sulfate may be injurious to the foliage and fruit. The mixture can be tested by dropping a few drops of yellow prussiate of potash (POISON) into a glass of the mixture. If a dirty brown precipitate is formed, more lime should be used. It is not necessary to use this test with any except No. 1, the standard Bordeaux mixture.

(b) In making No. 2, proceed as in (a) except that 3 gallons less of water is used. Then add 3 gallons of the soap suspension and stir.

(c) In making No. 3, proceed as in (b) except that 44 gallons of water and only 2 gallons of the milk of lime are used.

TIME OF SPRAYING

Spraying should begin in New Jersey about July first. In the extreme southern part of the state it should begin one week earlier. The plants should be sprayed every ten days or two weeks throughout the months of July and August. Use 100 to 150 gallons of the mixture per acre and apply at a pressure of 125 to 150 pounds. Use at least three nozzles to the row; one from above directing the spray downward and one from each side directed toward the plant.

Seed-bed spraying is of very little advantage in the direct control of the fungus but is helpful in the control of insects.

RESULTS OF SPRAYING

(1) Sprayed plants hold their foliage longer and produce more fruit than unsprayed plants. The increase in production is during the latter half of the season. The very late fruit can be ripened after picking and very frequently brings a high price on the market.

(2) The sprayed plants have more foliage than the unsprayed plants, thus giving a better shade which prevents sun-burning and scalding of the fruit. This fruit is better in color and flavor than fruit from unsprayed plants.

NOTE

SOURCE OF DATA. This circular is the result of experiments carried on during 1916 and 1917. The 1916 experiments were in cooperation with the Office of Cotton and Truck and Forage Crop Disease Investigations of the United States Bureau of Plant Industry and the H. J. Heinz Company. They were conducted near Salem, N. J., and were under the direct charge of the junior author. The 1917 tests were in cooperation with the same office and with the Campbell Soup Company, near Riverton, N. J., and also were under the direct supervision of the junior author.

OTHER TOMATO DISEASES. Circular 71 of the New Jersey Agricultural Experiment Station gives a general discussion of tomato diseases.